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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* DAVID J. COOPERBERG, VAHID VAHEDI,  
DOUGLAS RATTO, HARMEET SINGH, and NEIL BENJAMIN

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Appeal No. 2008-006350  
Application 10/024,208  
Technology Center 1700

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Decided: August 31, 2009

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Before ALLEN R. MACDONALD, *Vice Chief Administrative Patent Judge*, and  
EDWARD C. KIMLIN, CHARLES F. WARREN, CATHERINE Q. TIMM, and  
MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON REQUEST FOR REHEARING

Appellants filed a Request For Rehearing pursuant to 37 C.F.R. § 41.52 on April 27, 2009, of our decision entered February 27, 2009, wherein we affirmed the Examiner's grounds of rejection under 35 U.S.C. § 103(a). Req. 1.

Requests for rehearing must comply with 37 C.F.R. § 41.52(a)(1) which specifies in pertinent parts that “[t]he request for rehearing must state with

particularity the points believed to have been misapprehended or overlooked by the Board.”

Appellants contend we (1) did not give proper weight to the claim elements “common gas supply” and “process gas” which recite functional relationships (Req. 1 and 2-8); (2) did not properly consider a prior art reference in its entirety; (3) ignored substantial evidence of nonobviousness; and (4) took a substantially different position than the Examiner with respect to the prior art and the Cooperberg Declaration which is tantamount to a new ground of rejection. Req. 1-2 and 23.

We decide this appeal, including consideration of this Request for Rehearing, based on claims 1, 7, 15, and 51 as representative of the grounds of rejection and Appellants’ groupings of claims in the Appeal Brief, as set forth in the Decision. Dec. 4.

Issue 1: Whether the Panel properly considered the claim terms “common gas supply” and “process gas” in the context of appealed claims 1, 7, 15, and 51

Appellants contend that we and the Examiner improperly interpreted the claims with respect to the claim terms “common gas supply” and “process gas.” Req., e.g., 1 and 5. These claim terms are emphasized in the relevant portion of representative appealed independent claim 1:

1. A plasma processing system comprising:

....

a gas injector extending through the dielectric member, the gas injector comprising a body including an axial end surface exposed within the processing chamber, a side surface extending axially from the axial end surface, and a plurality of gas outlets including at least one on-axis outlet in the axial end surface and a plurality of spaced-apart off-axis outlets in the side surface, the off-axis outlets inject *process gas* at an acute angle relative to a plane parallel to an exposed surface of the substrate;

a *common gas supply* in fluid communication with a first gas line and a second gas line, the first gas line being in fluid communication with the on-axis outlet but not with the off-axis outlets and the second gas line being in fluid communication with the off-axis outlets but not with the on-axis outlet;

flow controllers operable to supply *process gas* from the *common gas supply* at flow rates that are independently varied between the on-axis outlet and the off-axis outlets into the processing chamber; . . . .

According to Appellants, “the claims are directed to a plasma processing system wherein a common gas supply necessarily delivers the same process gas (or identical gas composition as argued by the Examiner) to an injector.” Req. 2.

Appellants further state that “[t]he claimed plasma processing system includes a ‘common gas supply’ and other components which cooperate to deliver ‘process gas’ from the ‘common gas supply’ to an injector which supplies the process gas into a processing chamber wherein the process gas is energized into a plasma state.” Req. 3. In Appellants’ other words, “[t]he common gas supply necessarily delivers the same ‘process gas’ from the common gas supply to first and second lines supplying the process gas to on-axis and off-axis outlets;” “[a]ll of the independent claims recite that the process gas . . . is supplied through the on-axis and off-axis outlets which are in fluid communication with the ‘common gas supply’ through either the first or second gas line;” and “[t]he claimed system is designed to distribute process gas between on-axis and off-axis outlets of the injector.” Req. 3, 6, and 7.

Appellants’ view of the claimed system consistently recognizes that any “common gas supply” must deliver a “process gas” via fluid communication with first and second lines to the on-axis and off-axis outlets of an injector which in turn supplies the “process gas” to a processing chamber. Appellants’ view thus accounts for the apparatus structure of the claimed system for moving a “process

gas” from a “common gas supply” through first and second lines to the on-axis and off-axis outlets of the injector and thus to the reaction chamber, as specified in the appealed claims.

The difficulty with Appellants’ view is that it does not account for the apparatus structure of the “common gas supply.” This structure is not specified in the appealed claims. Contrary to Appellants’ position, we and the Examiner addressed these issues in construing the appealed claims.

Appellants assert that we should have reversed the grounds of rejection on the sole basis that the Examiner treated the claim terms “common gas supply” and “process gas” as “intended use” limitations. Req. 2. We cannot subscribe to Appellants’ contention.

We initially point out that Appellants’ position is undermined by their statement “[i]n the Examiner’s Answer, the Examiner gave weight to the claimed ‘common gas supply’ and ‘supply of process gas from the common gas supply.’” Req. 23, citing Ans. 8; *see above* pp. 26-27.

The Examiner, in responding to Appellants’ contentions in the Appeal Brief that Goodyear does not disclose a “common gas supply,” advanced the position “[i]f the prior art is capable of performing the intended use, then it meets the claim. The apparatus of [Goodyear] is capable of supplying a common gas to the processing chamber.” Ans. 13; *see App. Br.*, e.g., 30-31. Appellants’ arguments in reply were not directed to the term “common gas supply” per se but to the use of the term in the context of the phrase “a common gas supply in fluid communication with a first gas line and a second gas line” with respect to the issue of whether Goodyear provided a “common gas supply.” Reply Br. 8.

Upon consideration of the positions of the Examiner and Appellants, we were of the opinion the Examiner did give patentable weight to the term “common gas supply” in the context of the subject phrase as specifying that the apparatus structure of the claimed system must have the capability to supply a “common gas,” that is, the same gas, to each of the first and second gas lines. *See, e.g., Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1118-19 (Fed. Cir. 2004) (the term “‘operatively connected’ . . . is a general descriptive term frequently used in patent drafting to reflect a functional relationship between claimed components . . . [and generally] means the claimed components must be connected in a way to perform a designated function”). This accords with the position “[a] functional limitation is used in association with an element to define a particular capability or purpose that is served by the recited element,” taken by another merits panel of this Board, relying on *Innova/Pure Water*, 381 F.3d at 1117-20, in the non-precedential opinion entered on March 5, 2009, in Appeal 2009-1040 in Application 10/968,444, cited by Appellants. Req. 2.

We also interpreted the term “common gas supply” in the context of the two claim clauses, in pertinent part, “a *common gas supply* in fluid communication with a first gas line and a second gas line,” and “flow controllers operable to supply *process gas* from the *common gas supply* at flow rates that are independently varied,” in claim 1 (emphasis supplied):

We further determine claim 1 specifies common gas supply 23 is in fluid communication with first gas line having flow controller 36a that is in fluid communication with only on-axis injection outlet 24, and with second gas line having flow controller 36b that is in fluid communication with only off-axis outlets 26, wherein the respective

flow controllers independently vary the gas flow in the lines. *See Spec.* 11-13.

Dec. 6.

We determined it is apparent from the claim language that specific apparatus structure limitations are specified with respect to the separate gas supply to the on-axis and the off-axis injector outlets, leaving the term “common gas supply” to functionally cover the gas supply structure to the flow controllers of the respective first and second gas lines:

We interpret the term “common gas supply” in light of the Specification to encompass any gas supply structure capable of supplying the same gas to both gas lines. Indeed, there is no claim language or disclosure in the Specification which limits the common gas supply to a single gas line that is in fluid communication with the gas lines to the gas outlets as illustrated in Figures 1 and 2a-c. *See Spec.* 11-12.

Dec. 6. Thus, we specifically considered the term “common gas supply” in the context of the claim language to impart apparatus structural limitations on the apparatus falling within system claims 1, 7, 15, and 51.

We specifically noted, however, that there is no structural limitation imparted by the specific ingredients in a gas that is commonly supplied to both the first and second gas lines:

The term “common gas supply” does not encompass a particular gas such as a “process” gas as stated in claim 1, “a gas mixture” as stated in claim 51, or “the same gas composition” as Appellants contend, because such recitations do not structurally limit any apparatus component of the claimed system. *See App. Br.*, e.g., 16; *see also Reply Br.* 7-8.

Dec. 6. Indeed, we find no specific structural components for specific gas ingredients or mixtures thereof, including “process gas,” disclosed in the

Specification, and Appellants do not point to any such disclosure in the Briefs or the Request. *See generally* App. Br. and Reply Br.; *see* Req. 2-8.

In this latter respect, we stated:

In this respect, we point out that a “gas” on which an apparatus component can perform work does not confer a structural limitation on the claimed system.

Dec. 6. In doing so, we relied on the authoritative precedent of the predecessor court to our reviewing court: *In re Otto*, 312 F.2d 937, 939-40 (CCPA 1963); *In re Rishoi*, 197 F.2d 342, 344-45 (CCPA 1952); *In re Young*, 75 F.2d 996 (CCPA 1935); *In re Smith*, 36 F.2d 302, 303 (CCPA 1929). Dec. 6-7. *See South Corp. v. United States*, 690 F.2d 1368, 1370-71 (Fed. Cir. 1982) (*in banc*) (adopting the body of law represented by the holdings of the Court of Customs and Patent Appeals as of the close of business on September 30, 1982, as binding precedent). This guidance is applicable to the facts of this case. The difference in the facts found in the majority opinion and in the minority opinion leading to a difference in claim interpretation as a matter of law in the non-precedential opinion entered on February 25, 2009, in Appeal 2008-3846 in Application 10/428,207, cited by Appellants, did not result in a majority opinion or a dissenting opinion that reflected the position of the Board in a contrary manner. Req. 6-7.

Thus, as a matter of law, we are of the opinion that an apparatus falling within systems encompassed by claims 1, 7, 15, and 51, can supply by any means any manner of gas for any intended purpose to the injector including, for example, a “process gas” to, e.g., deposit a substrate, purge the reactor, or, clean the reactor, as long as it is a “common gas” having the same ingredients supplied through the flow controllers to the first and second gas lines to the respective on-axis and the off-axis injector outlets of the injector.

Accordingly, it is clear from our decision that we interpreted the claim term “common gas supply” to impart a functional relationship while the claim term “process gas” does not. We are not persuaded otherwise by Appellants’ arguments. Indeed, Appellants’ contentions disregard the part of our decision where we interpreted the term “common gas supply” in the context of the claim language and the disclosure in the Specification as providing a functional relationship and thus, an apparatus structural element in association with the apparatus structural elements specifically required in the claim. Req. 2-8. We further interpreted claims 1, 7, 15, and 51 to require any manner of gas, including any manner of “process gas,” must flow from the “common gas supply” through the flow controllers and associated lines to the on- and off-axis outlets of the injector. Indeed, the requirement in claim 1 (emphasis supplied) that “the off-axis outlets inject *process gas* at an acute angle relative to a plane parallel to an exposed surface of the substrate” specifies a capability of the off-axis outlets of the injector without regard to the ingredients of the “process gas” or the apparatus structure of the “common gas supply” in fluid communication with the line supplying the “process gas” to the off-axis injector.

Issue 2: Whether the Panel properly considered each prior art reference in its entirety

Appellants submit we “improperly relied on a background portion of . . . Goodyear . . . to the exclusion of other portions of Goodyear teaching away from doing what [we] considered obvious in view of Goodyear’s background discussion.” Req. 8. Appellants contend we “relied on an isolated teaching in Goodyear which is criticized by Goodyear as producing non-uniform plasma deposition and etching.” Req. 8-9, citing Dec. 14:1-14, quoting Goodyear col. 1, ll. 54-67. Appellants point out “Goodyear overcomes the problem of non-

uniformity arising from using the same gas mixture supplied at different flow rates to central and peripheral areas by instead using separate gas supplies to control the gas composition.” Req. 9, quoting Goodyear col. 2, ll. 54-67. According to Appellants, “Goodyear explicitly discredits use of an arrangement which delivers the same gas to inner and outer zones in plasma processing of substrates due to non-uniformity in deposition and etching.” Req. 11. Appellants contend we improperly ignored Goodyear’s teaching away from a common gas supply and thus, improperly found Goodyear would have led to the reasonable inference that the same process gas can be supplied to each of the chambers of the showerhead injector. Req. 11, citing Dec. 11:7-13 and 22:3-6.

Appellants assert “[i]gnoring Goodyear’s teaching away cannot be a reasonable inference to do what Goodyear says not to do” on the basis that we provided “no apparent reason to ignore the discussion in Goodyear criticizing the supply of the same gas composition at different flow rates to central and peripheral areas” of the showerhead injector. Req. 11-12, citing Goodyear col. 1, ll. 39-67, and col. 2, ll. 54-67.

On this basis, Appellants further submit we relied on teachings of Ballance and Arami which are discredited by Goodyear. Req. 9-10 and 10-11. According to Appellants, “[o]nly Balance’s FIG. 8 shows an arrangement where the same process gas is fed to inner and outer chambers [of the showerhead injector] but Goodyear teaches such arrangements produce non-uniform results.” Req. 14-15; *see also* 8-9, citing Dec. 15:16-24, and Ballance, col. 3, ll. 1-15, col. 8, ll. 34-35, and Figs. 1-8. On the same basis, Appellants contend that in Arami, “three gas sources . . . which provide various gas mixtures to the various zones [of a three chamber showerhead injector for a heat processing apparatus] via mass flow

controllers . . . leads away from supply of the same process gas to different zones of the showerhead.” Req. 10-11, citing Arami col. 1, ll. 5-10, and Dec. 13:2-13.

Appellants argue “even if Arami is considered equivalent to Goodyear and Ballance for disclosure of connecting a single gas to multiple regions of a showerhead, Goodyear explicitly discredits use of an arrangement which delivers the same gas to inner and outer zones in plasma processing of substrates due to non-uniformity in depositing and etching.” Req. 11.

Appellants also submit we ignored “Chang’s teaching away” in disclosing that the top nozzle and the top vent permit independent control of gas flows “which improves film uniformity” thus allowing adjustment of film deposition parameters. Req. 12, citing Chang 9:25-28. Appellants point out that one gas can be introduced through the top nozzle and a different gas can be introduced through the top vent. Req. 12, citing Change 18:14-21. Appellants contend we acknowledged Chang’s teachings but “nonetheless erroneously state[d] Chang’s disclosure is ‘essentially the same as that of Arami, Goodyear, and Balance.’” Req. 12-13, citing Dec. 24:14-15. Appellants further contend Murugesh also teaches away by feeding a different gas through each of two outlets. Req. 13, citing Murugesh col. 8, ll. 1-26, and Fig. 3. Appellants thus argue that our “selective findings of fact” with respect to Murugesh, Chang, and Ballance “distort the record and improperly fail to evaluate the teachings of the references in their entirety.” Req. 13.

It is well settled that that a reference stands for all of the specific teachings thereof as well as the inferences one of ordinary skill in this art would have reasonably been expected to draw from the teachings, *see In re Fritch*, 972 F.2d 1260, 1264-65 (Fed. Cir. 1992); *In re Preda*, 401 F.2d 825, 826-27 (CCPA 1968), presuming skill on the part of this person. *In re Sovish*, 769 F.2d 738, 742-43 (Fed.

Cir. 1985). Appellants do not dispute our findings of fact with respect to the disclosure of any of Ni, Chung, Murugesh, Arami, Goodyear, and Ballance. *See* Dec. 8:3 to 15:24.

Just as all of the teachings of a reference should be considered, so should the whole of our consideration of the disclosure of Goodyear and the other references. We found the following in Goodyear:

We find that Goodyear would have evinced to one of ordinary skill in the art that in the plasma processing system disclosed in JP-A-56-873328, the gas mixture is supplied to the perforated electrode by the first supply line feeding a central area of the perforated electrode and by the second supply line feeding a peripheral area of the perforated electrode. The gas flow over the substrate is radially outwards from the central area. In this known apparatus and method the same gas mixture is fed to both the peripheral and center areas, but at different rates which are controlled by a first mass flow meter on the first supply line and a second mass flow meter on the second supply line. This permits a reduction of non-uniformities in the plasma between the central area and the peripheral area. Goodyear, col. 1, ll. 39-50; *see also* col. 1, ll. 22-38.

We find Goodyear would have disclosed to one of ordinary skill in the art, as illustrated by embodiments depicted in Figure 1, a perforated gas-feeding showerhead electrode 12 for the chamber of a plasma processing system that employs RF energy. Goodyear, e.g., col. 2, ll. 11-53, and col. 3, 1, 64 to col. 4, 1, 19. Showerhead electrode 12 has first supply line 21 that feeds central area 12a, and second supply line 22 that feeds annular peripheral area 12b. Goodyear, e.g., col. 2, ll. 11-53, col. 4, ll. 20-36, and Fig. 1. Goodyear discloses the problem that where an identical gas composition is fed via the lines 21 and 22, one of the gases in the composition can be depleted at a faster rate. Goodyear solves the problem by using valves and flow meters 26a, 23a, 24a, 55, 56 and 26b, 23b, 24b, 55, 56 in supply lines 21, 22, respectively, which provides the capability to independently adjust the amount of each of the ingredient gasses in the gas supplied to each of areas 12a, 12b of perforated electrode 12 so that "the plasma treatment

is carried out more uniformly over the area of the . . . electrode.”  
Goodyear, e.g., col. 2, ll. 11-67, and col. 4, l. 43 to col. 5, l. 59.

Dec. 14:1 to 15:2.

We fully considered whether Goodyear’s disclosed invention constitutes a disclosure which would have led one of ordinary skill in the art away from consideration of a common gas supply distribution in different chambers of a showerhead injector known in the art from the Japanese Patent Document as well as evinced by Goodyear as well as from the disclosures of Chang, Murugesh, Arami, Goodyear, and Ballance:

We further cannot agree with Appellants that . . . the teachings of Goodyear would have led this person away from using a common gas supply. App. Br. 27-28 and 30-32; Reply Br. 6-8. “A reference may be said to teach away when a person of ordinary skill, upon reading the reference would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.” *In re Gurley*, 27 F.3d 551, 552-53 (Fed. Cir. 1994). In other words, a prior art disclosure does not teach away if the “disclosure does not criticize, discredit, or otherwise discourage the solution claimed.” *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004).

....

We are also unpersuaded of a “teaching away” from a common gas supply by the disclosure of a problem with depletion of one of the reaction gases delivered through a showerhead injector. App. Br. 30-32, citing Goodyear, col. 4, ll. 48-56, and Cooperberg Declaration ¶ 12; Reply Br. 6-8; *see above* pp. 13-14. Goodyear’s disclosed solution to this problem is adjustment of the gases supplied to the injector, and thus a process adjustment. *See above* p. 14. Indeed, we find that the disclosed solution is a gas supply structure, the disclosure of which would have led one of ordinary skill in this art to the reasonable inference that the process gas supplied to each of areas 12a, 12b of the showerhead injector can be of the same composition. *Id.*

In this respect, Appellants acknowledge that Goodyear evinces that a similar plasma processing system in which the two chambers of the showerhead injector are in fluid communication with the same gas supply was known in the art. App. Br. 19, citing Goodyear, col. 1, ll. 20-53; *see above* pp. 13-14; cf., e.g., *In re Hedges*, 783 F.2d 1038, 1039-40 (Fed. Cir. 1986)[(footnote omitted).] Arami and Balance also disclosed such compartmentalized showerhead injectors as we have discussed above. *See above* pp. 13 and 15. Thus, one of ordinary skill in this art, armed with the knowledge in the art that an injector can be divided into chambers in order to regulate gas flow and composition as evidenced by Chang, Murugesh, Arami, Goodyear, and Balance, would not have been led away from using the concept of a showerhead injector having a plurality of chambers for independent control of gas flow taught by Arami, Goodyear, and Ballance by Goodyear's disclosure cited by Appellants. *See, e.g., Gurley*, 27 F.3d at 553 ("We share Gurley's view that a person seeking to improve the art of flexible circuit boards, on learning from Yamaguchi that epoxy was inferior to polyester-imide resins, might well be led to search beyond epoxy for improved products. However, Yamaguchi also teaches that epoxy is usable and has been used for Gurley's purpose.").

Dec. 21:6 to 23:13.

Indeed, it is apparent from our discussion that we fully considered the entirety of the disclosure of each of Chang, Murugesh, Arami, Goodyear, and Ballance, finding that each would have disclosed that a chambered showerhead injector can be used to regulate gas flow to the extent that Goodyear's disclosure did not constitute a "teaching away.". Dec. 12-13, 15, 18, and 23-25. In this respect, we further noted that Appellants were also aware of the disclosures of these references:

Appellants do not dispute that each of Chang and Murugesh discloses cylindrical injectors in which a center passage connects a gas supply with an on-axis outlet and an annular passage connects a different gas supply with off-axis outlets, and that the flow of gas in each of the lines supplying the different gases to the respective outlets

is independently controlled by flow controllers. *See above* 11-13; Ans. 8-9. Indeed, Appellants merely point out that these references supply different gas to each of the passages, and thus not the same gas from a common gas supply. App. Br. 18-19 and 25-27; Reply Br. 4-5.

Appellants also do not dispute that each of Arami, Goodyear, and Balance disclose a shower head injector separated into two or three chambers, each of which is in fluid communication with a gas line having a flow controller that regulates the gas flow for that line, or that each of Goodyear and Balance discloses that the gas lines for the chambers of the shower head injectors are connected to a gas source that supplies the same gas. *See above* pp. 13-15; App. Br., e.g., 19-20, 29-30, and 32. Contrary to Appellants' contentions, we agree with the Examiner that Arami would have disclosed to one of ordinary skill in this art that the gas lines for the chambers of the shower head injector are connected to gas sources that can supply the same gas using the flow controllers. *See above* p. 13; Ans. 9; App. Br. 20 and 32-33.

Dec. 18:4-24.

Accordingly, contrary to Appellants' contentions, we considered the disclosures of Chang, Murugesh, Arami, Goodyear, and Ballance in their entirety, finding significant evidence therein in leading to the reasonable conclusion that one of ordinary skill in this art would not have been led away from using a common gas supply structure to supply process gas to each chamber of a showerhead injector or other injector by Goodyear's disclosure. Thus, we are also not persuaded by Appellants' contentions that Goodyear's teachings would have prevented one of ordinary skill in this art from compartmentalizing Ni's injector to facilitate gas flow and composition. Req. 10 and 14-15.

Issue 3: Whether the Panel properly considered the evidence in the Cooperberg Declaration

I.

We divide Appellants' contention into several parts. We first consider Appellants' assertion that we "improperly rejected evidence submitted in the Cooperberg Declaration" in that we "completely disagreed with the expert testimony of Declarant Cooperberg," quoting a portion of our decision at page 24, lines 1-14, which cited ¶ 13 of the Cooperberg Declaration. Req. 15.

Actually, we did not disagree with Declarant Cooperberg's testimony in ¶ 13 of the Cooperberg Declaration. We did disagree with Appellants' reliance on that testimony with respect to a position taken by Appellants in the Appeal Brief, citing Chang, Murugesh, Arami, Goodyear, and Ballance in this respect:

Appellants also contend that one of ordinary skill in the art would not have looked to showerhead injector design with respect to construction and performance when used in RF capacitively-coupled plasma reactors in modifying Ni's injector for used in an RF inductively-coupled plasma processing system. App. Br. 28-30 and 33. . . . In this respect, Appellants further point out that Declarant Cooperberg's opinion that one of ordinary skill in the art "would not have selected references in the showerhead electrode art to modify the Ni gas injector, which is used in an ICP system," "is based on well-known differences in the art and reflects the knowledge in the art." App. Br. 28-29, *citing* Cooperberg Declaration ¶ 13.

We find that Declarant Cooperberg states, among other things, that "[r]egarding gas flow, because a showerhead includes many holes, the gas exit velocity is normally sufficiently low," and that "[t]he higher flow rate from a smaller number of holes for the claimed gas injector allows for more controlled directivity from the injector." Cooperberg Declaration ¶ 13.

We disagree with Appellants' position. We determine that one of ordinary skill in this art would have had knowledge that the flow of gas to outlets of an injector can be regulated by dividing the injector into chambers in order to regulate gas flow and composition as evidenced by Chang, Murugesh, Arami, Goodyear, and Balance. Each of these references would have disclosed that the gas flow to the outlets of an injector is regulated by compartmentalizing the injector

into passages or chambers, each in communication with a gas source via a gas line having a flow controller. *See above* pp. 11-15. Indeed, the disclosure of Chang and Murugesh in this respect is essentially the same as that of Arami, Goodyear, and Ballance. Thus, the structure of an injector considered by one of ordinary skill, in addressing the problem of control of gas to the outlets of an injector, would have been determined by the injector structure and not by the type of processing system in which the injector is used or the arrangement of the outlets. The testimonial evidence we find in ¶ 13 of the Cooperberg Declaration directed to gas flow rate is with respect to the injection of gas from a gas outlet of the injector and not with control of the flow of gas to that gas outlet with respect to gas distribution to the outlets of an injector, and thus, is not directed to the approach of one of ordinary skill in this art to that problem.

Dec. 23:14 to 24:25.

## II.

With respect to our determination based on Declarant Cooperberg's testimony at ¶ 13 of the Cooperberg Declaration and the evidence in Chang, Murugesh, Arami, Goodyear, and Ballance, Appellants contend “[t]he Decision . . . improperly rejected Appellants' rebuttal evidence on the basis that one of ordinary skill ‘would have had knowledge,’ a purely conclusory view of the prior art which fails to adequately consider Appellants' rebuttal evidence.” Req. 15-16. Appellants point to Ni's disclosure “that the number of gas outlets and/or angle of injection can be selected to provide the desired gas distribution in a particular substrate processing regime.” Req. 16-17, citing Cooperberg Declaration ¶ 10, and Ni 9:1-3. According to Appellants, Ni teaches the injector disclosed therein “provides improved uniformity compared to ‘conventional injection through a showerhead.’” Req. 17, citing Ni 17:22 to 18:4. Appellants argue “Declarant Cooperberg also explained why showerhead arrangements would not be considered by persons of ordinary skill in designing an injector for an inductively coupled

plasma system,” and Ni discloses “‘other problems’ with showerhead arrangements.” Req. 17, citing Cooperberg Declaration ¶ 13, and Ni 19:13-22.

Appellants thus assert that, even in view of Declarant Cooperberg’s testimony and the disclosure in Ni, we “made a ‘finding’ in rejecting Appellants’ rebuttal evidence but without citing any evidence in support of the finding.” Req. 17. Appellants contend that if our “decision to reject Appellants’ rebuttal evidence rests on a ‘high level of skill’ in the art or ‘common knowledge and common sense,’ such would constitute reversible error.” Req. 17-18, citing *In re Rouffet*, 149 F.3d 1350 (Fed. Cir. 1998), and *In re Lee*, 277 F.3d 1338 (Fed. Cir. 2002).

We disagree that our decision rests on such bases. It is apparent we considered Declarant Cooperberg’s testimony in ¶ 13 of the Cooperberg Declaration with respect to the issue raised by Appellants in the Appeal Brief, and determined that Declarant Cooperberg’s testimony did not address the issue. Dec. 23:14 to 24:25; *see above* pp. 15-16. In doing so, we pointed to the evidence in the disclosures of Chang, Murugesh, Arami, Goodyear, and Ballance that regulation of gas flow to the outlets of an injector can be improved by compartmentalizing the injector into chambers, each in communication with a gas source via a line having a flow controller. We further pointed out that the disclosures of Chang and Murugesh, the chambered injectors of which are not showerhead injectors, are essentially the same as the disclosures of Arami, Goodyear, and Ballance, which disclose chambered showerhead injectors. Accordingly, on the evidence in Chang, Murugesh, Arami, Goodyear, and Ballance, we determined “the structure of an injector considered by one of ordinary skill, in addressing the problem of control of gas to the outlets of an injector, would have been determined by the injector

structure and not by the type of processing system in which the injector is used or the arrangement of the outlets.” Dec. 24:16-20.

Our consideration of Appellants’ position in the Request has not changed our opinion that the structure of the gas supply to the gas outlets of an injector can be separated from the manner in which the gas is injected through the outlets of an injector by one of ordinary skill in this art. Indeed, the observation that this person would have made of the structure of the gas supply to the gas outlets of an injector as disclosed in Chang, Murugesh, Arami, Goodyear, and Ballance does not involve either an unsupported “high level of skill” in the art,” as in *Rouffet*, 149 F.3d at 1359, or unsupported “common knowledge and common sense,” as in *Lee*, 277 F.3d at 1343-44, as Appellants contend.

We were certainly mindful of Ni’s disclosure in these respects even though Appellants did not rely on Ni’s disclosure in the Briefs on the issue addressed. We find that Ni’s disclosure describing showerhead injectors with respect to, among other things, “the number of gas outlets and/or angle of injection angle,” and other attributes of showerhead injectors, as relied on by Appellants in the Request, is cumulative to Declarant Cooperberg’s testimony in ¶ 13 of the Cooperberg Declaration and thus, of the same effect. Req. 16-17, citing Ni. 17:22 to 18:4 and 19:13-22.

### III.

Appellants further assert we disregarded the showing of unexpected results in the Cooperberg Declaration “when compared to the combined teachings of the combined references.” Req. 18-19.

According to Appellants, we relied only on *In re Skoll*, 523 F.2d 1392, 1397 (CCPA 1975) for our otherwise “conclusory argument that the Cooperberg

Declaration did not establish unexpected results but rather ‘the evidence . . . does no more than show what one of ordinary skill . . . would have reasonably determined from consideration of the combined teachings of Ni, Chang, Murugesh, Arami, Goodyear, and Ballance,’ even though “there is no teachings in the cited references of the benefits discussed” in the Cooperberg Declaration. Req. 18, citing Dec. 28:15-20, Cooperberg Declaration ¶¶ 4-11, and *In re Nolan*, 553 F.2d 1261 (CCPA 1977).

Appellants further contend “Ni’s injector is designed for a particular application but Appellants’ [sic] discovered a need for adjustment of gas flows during sub-steps of a multi-step process,” and “[t]he claimed processing system provides unexpected advantages in this regard.” Req. 18, citing Cooperberg Declaration ¶¶ 9-11.

We did explain in our Decision that we considered “the evidence in the Specification and the Cooperberg Declaration as argued in the Briefs.” Dec. 25:12-16. We further consider this evidence here.

### III. A

Appellants contend that while we did not consider the evidence in the Cooperberg Declaration “to establish unexpected results when compared to the combined teachings of the combined references,” the evidence in “Goodyear’s teaching that supply of the same gas even with variable flow control to inner and outer zones lend to nonuniformity establishes that the ability of the claimed system to achieve uniform results should be considered as unexpected result.” Req. 19.

We disagree with Appellants’ position for the same reasons we set forth with respect to the disclosure of Goodyear above. *See above* pp. 11-15. Indeed, we find no evidence in the record comparing a claimed system falling within the appealed

claims, as we have interpreted them, with the system disclosed in Goodyear necessary to support Appellants' contention of unexpected results.

### III. B

Appellants assert they provided evidence in the Cooperberg Declaration "that showerheads operate in a fundamentally different way" with respect to a particular showerhead injector with "at least 1000 holes" that is "arranged 2 to 2.5 cm" from the substrate, "whereas the Ni injector is arranged . . . about 15 cm" from a substrate, which "distance" makes "zoned gas flow from an injector impossible due to the low gas flow rate and the predominantly [sic] diffusion dominated gas transport mechanism." Req. 19, citing Cooperberg Declaration ¶ 13.

Declarant Cooperberg attests:

the showerhead / wafer gap is typically about 2.25 cm in capacitively-coupled chambers. The gas injector / wafer gap is typically about 15 cm in an [inductively-coupled plasma processing system] chamber for processing 300 mm wafers. Regarding gas flow, because a showerhead includes many holes, the gas exit velocity is normally sufficiently low that diffusion becomes the dominant transport mechanism.

Cooperberg Declaration ¶ 13.

We find that Declarant Cooperberg does not refer to Ni's injector in any part of his testimony in ¶ 13 of the Cooperberg Declaration as Appellants assert. Req. 19. Indeed, we find that while Ni's plasma processing system is an inductively coupled plasma processing system, Declarant Cooperberg's testimony focuses on the performance of a showerhead injector in such a system without regard to Ni's injector. Cooperberg Declaration ¶ 13. Declarant Cooperberg's testimony also does not refer to the showerhead injector of Arami, Goodyear, or Ballance, or to the injectors of Chung or Murugesh which are not showerhead injectors.

Cooperberg Declaration ¶ 13.

We quoted a portion of the last sentence of this part of Declarant Cooperberg's testimony in ¶ 13 along with the penultimate sentence in ¶ 13 in our Decision:

We find that Declarant Cooperberg states, among other things, that “[r]egarding gas flow, because a showerhead includes many holes, the gas exit velocity is normally sufficiently low,” and that “[t]he higher flow rate from a smaller number of holes for the claimed gas injector allows for more controlled directivity from the injector.” Cooperberg Declaration ¶ 13.

Dec. 24:1-5; *see above* p. 14.

Thus, we considered Declarant Cooperberg's testimony in ¶ 13 of the Cooperberg Declaration in our Decision as well as reconsidered our position in those respects above in light of the teachings of Chang, Murugesh, Arami, Goodyear, and Ballance. *See above* pp. 16-18. Accordingly, we have considered and reconsidered Appellants' position, iterated here as Declarant Cooperberg's testimony is “uncontroverted evidence that one of ordinary skill would not consider the showerhead art in the design of an injector,” in view of which, “the Decision . . . does not explain why . . . [this] person . . . would have been led to modify Ni to include different passages to separately feed the on-axis and off-axis outlets” of Ni's injector, and reach no different conclusion. Req. 19

### III. C

Appellants contend “[o]ne advantage of Appellants [sic] plasma processing system is that it can be used to vary flow rates for multi-step etching,” and point out that “[t]he Cooperberg Declaration discusses the problem of providing a gas injector suitable for performing multi-steps in the same processing chamber.” Req. 20, citing Appeal Brief 14:21-24 and 15:13-19, and Cooperberg Declaration ¶ 6.

Appellants assert we “ignored Appellants [sic] evidence of unexpected results stating ‘there is little support in the record for Appellants’ contention that the problem addressed by the claimed injector is one or [sic, of] providing an ‘etch uniformity in different steps of a multi-step process,’” citing certain portions of the Appeal Brief and the Cooperberg Declaration. Req. 20, citing Dec. 20:12-16. Appellants argue there is ample support in the cited portions of the Appeal Brief and the Cooperberg Declaration. Appellants further assert that to the extent we used “the term ‘record’ to refer to Appellants [sic] specification,” the same is contrary to law. Req. 20.

We stated:

Turning now to Appellants’ contentions that a prima facie case has not been established by the evidence in the applied references, we agree with Appellants that one of ordinary skill in this art would find in Ni the teachings that the outlets of the injector are arranged, as stated by Ni, “to provide desired gas distribution in a particular substrate processing regime.” *See above* p. 9; App. Br., e.g., 14-15 and 22-24, citing Cooperberg Declaration ¶¶ 3, 5, and 6. However, contrary to Appellants’ contentions, we are of the opinion that Ni’s disclosure of different arrangements of on- and off-axis gas outlets for aluminum (all off-axis outlets) and polysilicon (one on-axis outlet and remainder off-axis outlets) etch processes in order to provide the desired gas distribution for the processes, would have reasonably suggested to one of ordinary skill in this art that the capability to close off the on-axis gas outlet in the axial end of an injector would result in an injector that can provide desired gas distribution for both aluminum and polysilicon etch processes. *See above* pp. 9-10.

Indeed, this person would have been armed with the knowledge in the art that an injector can be divided into passages or chambers in order to regulate gas flow and the composition of that gas in providing the desired gas to outlets of the injector as evidenced by Chang, Murugesh, Arami, Goodyear, and Ballance. *See above* pp. 11-15. Thus, this person would have readily recognized that a change in the structure of Ni’s injector using separate passages or chambers to

control the flow of gas to different gas outlets, as known in the art, would facilitate separate control of the on- and off-axis gas outlets in Ni's injector, thereby permitting the modified injector to be used in different etch processes.

In this respect, there is little support in the record for Appellants' contention that the problem addressed by the claimed injector is one of providing an "etch uniformity in different etch steps of a multi-step etch process" which would not have been recognized by one of ordinary skill in this art. App. Br., e.g., 13-16, 21-24, and 38-39, citing Cooperberg Declaration ¶¶ 3-6. Indeed, one of ordinary skill in this art would have required only the simple observation of the difference between Ni's injectors for etching aluminum and polysilicon to recognize that the problem with using the same injector in these different etching processes is the presence and absence of an on-axis gas outlet in the axial end. Thus, this person would have reasonably concluded that control of the on-axis gas outlet would permit use of the same injector in both etching processes.

Dec. 19:1 to 20:23.

We cannot subscribe to Appellants' position. Appellants do not explain why the evidence in the portions of the Appeal Brief and the Cooperberg Declaration which we cited would have led to a different result. Appellants also do not explain the manner in which we improperly relied on the disclosure in Appellants' Specification in reaching our determination.

### III. D

Appellants point out the injector of the claimed processing system can perform different functions than Ni's injector in obtaining uniform etching during multi-step processes, and contend they have "conclusively established the claimed injector provides improvements over Ni" in these respects, "a use not mentioned in Ni." Req. 21.

Appellants assert we erred in our statement at pages 21, lines 18-24, of the Decision. Req. 21. We quote the whole:

We further cannot agree with Appellants that the teachings of Ni would have led one of ordinary skill in this art away from considering the showerhead injector art set forth in Arami, Goodyear, and Ballance . . . . App. Br. 27-28 and 30-32; Reply Br. 6-8.

In this respect, we find no evidence in Ni that the disclosure “instead of using a gas ring or showerhead to supply process gas into the chamber, the gas injector is mounted in an opening through the dielectric window,” establishes one of ordinary skill in this art would have been discouraged from considering showerhead injectors having a plurality of chambers for independent control of gas flow in modifying Ni’s injector, as Appellants contend. App. Br. 27-28, citing Ni 9:13-15. Indeed, the statement is made with respect to the modification of a particular plasma etch reactor made by LAM Research Corporation to demonstrate Ni’s injector, and thus does not constitute a preference for any particular injector. Ni 9:9-13.

Dec. 21:6 to 22:2 (citations omitted).

In the Request, Appellants cite disclosure in Ni at page 17, line 26, to page 18, line 9, which was not cited in the Briefs. Req. 21; *see* App. Br., e.g., 22,23, 27, and 41; Reply Br., e.g., 3 and 4. We find in Ni’s disclosure now cited by Appellants, a broadly stated comparison of Ni’s disclosed invention as a whole with respect to etch uniformity of metals, conductive semiconductor materials, and dielectric materials, in contrast to a variety of problems associated with a conventional injection system using a showerhead. We fail to find in the cited disclosure support for Appellants’ contention that Ni describes “nonuniform etching using a showerhead . . . because etch by-products stagnate above the center of the substrate and transport is essentially through diffusion alone . . . . Req. 21.

Appellants further cite disclosure in Ni at page 14, lines 3-5 and 9-14. Req. 21-22. We cited this disclosure as well. Dec. 9:28 to 10:12, 17:7-9. In this disclosure, Ni describes the advantages of the disclosed injector, but does not compare the same to a showerhead injector.

We agree with Appellants' contention that the cited portions of Ni's disclosure establishes that Ni's injector in Ni's plasma processing system can improve etch uniformity compared to a showerhead injector containing processing system. However, we remain of the view that such teachings in Ni would not have led away from the teachings that one of ordinary skill in this art armed with the knowledge in the art provided by the combined teachings of Ni, Chang, Murugesh, Arami, Goodyear, and Ballance would have found therein. *See above* pp. 22-24.

### III. E

Finally, Appellants' contentions with respect to the disclosure of Goodyear leading away from the claimed invention are of no more persuasion now than before. Req. 21-22; *see above* pp. 11-15 and 19-20.

### IV.

On this record, we have properly considered the evidence in the Cooperberg Declaration. On this basis, we disagree with Appellants' contention that "the totality of the record in the present appeal weighs in favor or patentability of the appealed claims." Req. 21.

Indeed, we have considered and reconsidered the evidence in the disclosures of Ni, Chang, Murugesh, Arami, Goodyear, and Ballance and in the Cooperberg Declaration as argued by Appellants in the Briefs and in the Request, following the guidance of our reviewing court and its predecessor court that "[f]acts established by rebuttal evidence must be evaluated along with the facts on which the earlier conclusion [of *prima facie* obviousness] was reached, not against the conclusion itself." *In re Rinehart*, 531 F.2d 1048, 1052 (CCPA 1975) (the affidavit contained "unrebutted facts"); *accord In re Piasecki*, 745 F.2d 1468, 1472-73 (Fed. Cir.

1984), quoting *In re Rinehart*, 531 F.2d at 1052 (“appellants submitted extensive evidence of peer recognition, long-felt need, and commercial interest”).

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of Ni, Chang, Murugesh, Arami, Goodyear, and Ballance and as further combined with Powell, with Appellants’ countervailing evidence of and arguments for nonobviousness, and conclude, by a preponderance of the evidence and weight of argument, that on balance, the claimed invention encompassed by appealed claims 1 through 11, 13 through 15, and 39 through 61 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

Issue 4: Whether the Panel took a substantially different position than the Examiner with respect to the prior art and the weight to be given to the Cooperberg Declaration

Appellants contend we should designate our decision as a new ground of rejection. According to Appellants, the Examiner gave weight to the claim term “common gas supply” and the claim phrase “supply of process gas from the common gas supply” while we did not, and we further took a new position with respect to Ni. Req. 23, citing Ans. 8.

We disagree. We determined above that we, like the Examiner, appropriately considered the subject claim language. *See above* pp. 2-8. Furthermore, Appellants do not explain how our consideration of Ni differs from that of the Examiner. Req. 23. Our consideration of the disclosure of Ni in the Decision was in response to arguments raised by Appellants in the Briefs, and included consideration of Ni in light of the evidence in Chang, Murugesh, Arami, Goodyear, and Ballance along with the evidence in the Cooperberg Declaration, all

well considered by Appellants in the Briefs. We have further considered Ni based on Appellants' further arguments now raised in the Request. *See above* pp. 19-25.

Appellants also contend we took a position in the two separated sentences appearing at page 19, lines 8-15 and 20-25, of the Decision which differs substantially from the Examiner's reasoning in the answer. Req. 23-24, quoting Dec. 19:8-15 and 20-25. According to Appellants, the Answer noted various deficiencies of Ni but did not take the position "that Ni 'reasonably suggested' the claimed invention." Req. 24.

We quoted above the portion of the Decision that provides the full context of our position surrounding the two sentences quoted by Appellants in the Request. Req. 23-24; *see above* pp. 22-23. It is apparent therefrom that we considered the teachings of Ni combined with the teachings of Chang, Murugesh, Arami, Goodyear, and Ballance in response to the arguments raised by Appellants in the Briefs, and the evidence in the applied references was well considered by Appellants in these respects. *See generally* App. Br. and Reply Br.

This combination of references has been applied in the ground of rejection as providing evidence that would have led one of ordinary skill in this art to modify Ni's injector by using an injector with chambers that are separately supplied with gas from a common gas supply. Ans., e.g., 7-10, 16-17, and 18. In this respect, the Examiner takes the position with respect to the evidence in the Cooperberg Declaration that, based on the combined teachings of the references, "it would have been expected that added controllability to the injector of [Ni] would allow for improved controllability and better results with respect to different etching processes, as shown by the declaration." Ans. 19. Thus, one of ordinary skill in this art, armed with knowledge of Ni, Chang, Murugesh, Arami, Goodyear,

and Balance, would have had a reasonable expectation of adjusting the flow and ingredients of gas supplied to outlets of a chambered injector and would have viewed the teachings of Ni accordingly, as we and the Examiner point out.

We are not persuaded by our consideration of all of Appellants' contentions in the Request addressing these positions that our consideration of Appellants' positions in the Briefs resulted in a different position than that advanced by the Examiner.

We note Appellants further submit that our position was based on *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), which they contend "was decided after the Examiner's Answer was issued," thus leading to a different position than taken by the Examiner. Req. 24.

Contrary to Appellants' position, the Examiner's Answer was mailed January 7, 2008, in response to the Appeal Briefs filed June 14, 2007, and October 9, 2007, and the Reply Brief was filed March 21, 2008. Thus, all appeal documents we considered in arriving at our Decision were entered in the record after *KSR* was handed down on April 30, 2007.

Accordingly, on this record, we are not persuaded by our consideration of all of Appellants' contentions in the Request to designate our Decision as a new ground of rejection.

In conclusion, based on the foregoing, we have granted Appellants' Request to the extent we have reconsidered our decision, but we deny it with respect to making any change therein.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a)(1)(iv) (2005).

Appeal No. 2008-006350  
Application 10/024,208

DENIED

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